Published for SISSA by Springer

Received: October 7, 2019
Revised: January 28, 2020
Accepted: March 28, 2020
Published: April 14, 2020

On stabilization of Maxwell-BMS algebra

JHEP04(2020)073

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Abstract: In this work we present different infinite dimensional algebras which appear as deformations of the asymptotic symmetry of the three-dimensional Chern-Simons gravity for the Maxwell algebra. We study rigidity and stability of the infinite dimensional enhancement of the Maxwell algebra. In particular, we show that three copies of the Witt algebra and the $\mathfrak{bms}_3 \oplus \mathfrak{witt}$ algebra are obtained by deforming its ideal part. New family of infinite dimensional algebras are obtained by considering deformations of the other commutators which we have denoted as $M(a,b;c,d)$ and $\bar{M}(\bar{\alpha},\bar{\beta};\bar{\nu})$. Interestingly, for the specific values $a=c=d=0, b=-\frac{1}{2}$ the obtained algebra $M\left(0,-\frac{1}{2};0,0\right)$ corresponds to the twisted Schrödinger-Virasoro algebra. The central extensions of our results are also explored. The physical implications and relevance of the deformed algebras introduced here are discussed along the work.

Keywords: Conformal and W Symmetry, Space-Time Symmetries, Gauge-gravity correspondence

ArXiv ePrint: 1909.12827

https://doi.org/10.1007/JHEP04(2020)073

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1 Introduction and motivations

Symmetry is the cornerstone of the modern theoretical physics. Among different symmetries, the symmetries of spacetimes have attracted more attentions. One particular symmetry is the Poincaré algebra which is isometry of Minkowski spacetime and field theories on flat space enjoy Poincaré invariance. Depending on the theory and its field content, field theories typically exhibit invariance under bigger symmetry algebras which can be seen as extensions and deformations of the Poincaré algebra.

A well-known extension and deformation of the Poincaré algebra is given by the Maxwell algebra which is characterized by the presence of an Abelian anti-symmetric two tensor generators $\mathcal{M}_{\mu\nu}$ such that the generators of translations obey $[\mathcal{P}_\mu, \mathcal{P}_\nu] = \mathcal{M}_{\mu\nu}$. This algebra was first introduced in [1, 2] where it describes a particle in an external constant electromagnetic field background, see also [3, 4]. This algebra can be obtained from the study of Chevalley-Eilenberg cohomology of Poincaré algebra [5, 6]. In the context of the gravity by gauging the $4d$ Maxwell algebra an extension of General Relativity (GR) is obtained which includes a generalized cosmological term [7]. Subsequently, in the context